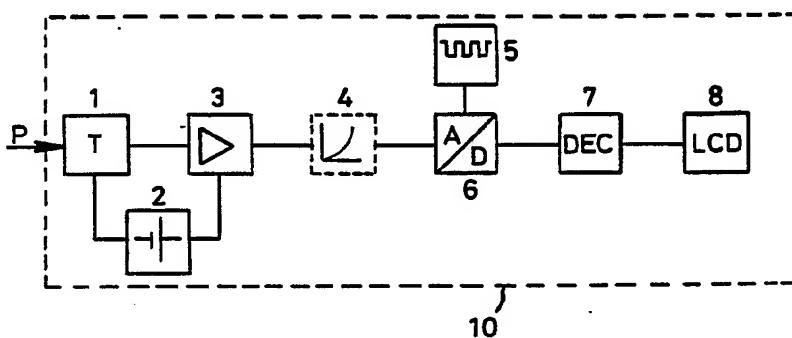




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G01L 19/00, B05B 15/00		A1	(11) International Publication Number: WO 91/16610 (43) International Publication Date: 31 October 1991 (31.10.91)
(21) International Application Number: PCT/GB91/00652		(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), US.	
(22) International Filing Date: 24 April 1991 (24.04.91)			
(30) Priority data: 9009190.1 24 April 1990 (24.04.90) GB			
(71) Applicant (<i>for all designated States except US</i>): ITW LIMITED [GB/GB]; St Marks House, St Marks Road, Windsor, Berkshire SL4 3BD (GB).		Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(72) Inventor; and			
(75) Inventor/Applicant (<i>for US only</i>) : SMITH, Rowland, Charles [GB/GB]; 20 Venator Place, Wimborne, Dorset BH21 1DQ (GB).			
(74) Agent: GODDARD, George, William, John; Hughes Clark & Co., 114-118 Southampton Road, London WC1B 5AA (GB).			

(54) Title: MINIATURE ELECTRONIC PRESSURE GAUGE



(57) Abstract

A miniature electronic pressure gauge is described comprising a case (10) having an aperture leading to a transducer (1) connected to an amplifier (3), the transducer (1) and amplifier (3) being powered from a power source (2) in the form of a storage battery such as a Nicad battery. A pressure signal from the amplifier (3) is fed to a linearisation circuit (4) and to an analogue/digital converter (6) clocked with pulses from clock generator (5). The output of converter (6) is fed to a decoder/driver (7) for a seven segment L.C.D. (8). In a preferred construction the pressure gauge is releasably retained in a fluid-tight engagement in a bore in the wall of a pressure chamber of a paint spray gun.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America

MINIATURE ELECTRONIC PRESSURE GAUGE

This invention relates to a miniature preferably digital electronic pressure gauge.

More particularly, the invention provides pressure 5 transducer means in a sealed enclosure having its own power source, said enclosure being retained by releasable retaining means in fluid-tight engagement in a cavity in a wall of a pressure chamber, said cavity leading to the interior of the chamber.

10 The transducer as aforesaid may be fitted to a paint spray gun, and is removably fastened by means of a screw or bayonet fitting.

Various embodiments of the invention will now be described, by way of example only, with reference to the 15 accompanying drawings, in which:

Fig. 1 is a block diagram of a miniature digital electronic pressure gauge according to the invention providing for display of the measured pressure;

Fig. 2 is a block diagram of a second form of the 20 pressure gauge providing an output signal for further processing;

Figs. 3 to 5 are respectively a fragmentary perspective view of a spray gun having a pressure gauge according to the invention fitted thereto, a sectional 25 view of the gun showing the path taken therethrough by compressed air, and a detail section showing how the gauge is retained in the gun body; and

Fig. 6 is a side view of a second form of a spray gun.

30 In Fig. 1 a miniature digital electronic pressure gauge comprises a case 10 having an aperture leading to a transducer 1 connected to an amplifier 3, the transducer 1 and amplifier 3 being powered from a power source 2 in the form of a small storage battery. A pressure signal 35 from the amplifier 3 is fed (if necessary) to a linearisation circuit 4 and thence to an analogue/digital converter 6 clocked with pulses from clock generator 5.

The output of converter 6 is fed to decoder/driver 7 for a seven-segment display 8 of the liquid crystal type. The casing 10 is made of high grade stainless steel and is sealed against the ingress of liquid or gaseous fluids 5 under pressure. By this means the unit is intrinsically safe for use in hazardous areas. The power source 2 is a nicad battery such as is now common in calculators and watches. On the exhaustion of the cell 2, the unit may be discarded to be replaced with a new sealed unit. The 10 unit is desirably accurate to within 2% and can read from 0 to 400 PSI; it is important that it should always read 0 under nil applied pressure.

The unit of Fig. 2 is similar to that of Fig. 1 except that an output signal 15 is taken from the 15 linearisation circuit 4.

In Figs. 3 to 5 the unit of Fig. 1 is shown fitted to a manually operated paint spray gun. A threaded aperture in a casing 20 of the gun accepts a retaining bush 22 in which the pressure gauge unit is fitted. The 20 bush 22 seats on an O-ring 24 in the body 20, and a bore 26 leads from a region of the air path downstream of the trigger 28 and adjacent the spreader control valve 30 to the aperture in the casing 10.

In Fig. 6 there is shown a paint spraygun for 25 automatic operation having a body 31 fitted with pressure transducers 33, 35 in the fluid and air supply paths.

It will be appreciated that transducers of similar structure may be fitted to compressors, air regulators, fluid regulators, tyre pressure gauges and control 30 panels.

CLAIMS:

1. A pressure transducer means comprising a sealed enclosure for said pressure transducer means, a power source for supplying power to said transducer means, a releasable retaining means, a walled pressure chamber defining a bore in said wall wherein said sealed enclosure is retained by said releasable retaining means in fluid-tight engagement in said bore and said bore leads to the interior of said pressure chamber.
2. A pressure transducer as claimed in Claim 1, wherein said transducer releasably fits into said bore by a screw-threaded retaining means.
3. A pressure transducer as claimed in Claim 1, wherein said transducer releasably fits into said bore by a bayonet retaining means.
4. A paint spray gun having a body defining an interior space through which air under pressure can be passed, a bore defined in said body leading from said interior space, wherein said bore leads to a pressure transducer as claimed in Claim 1.

1-4

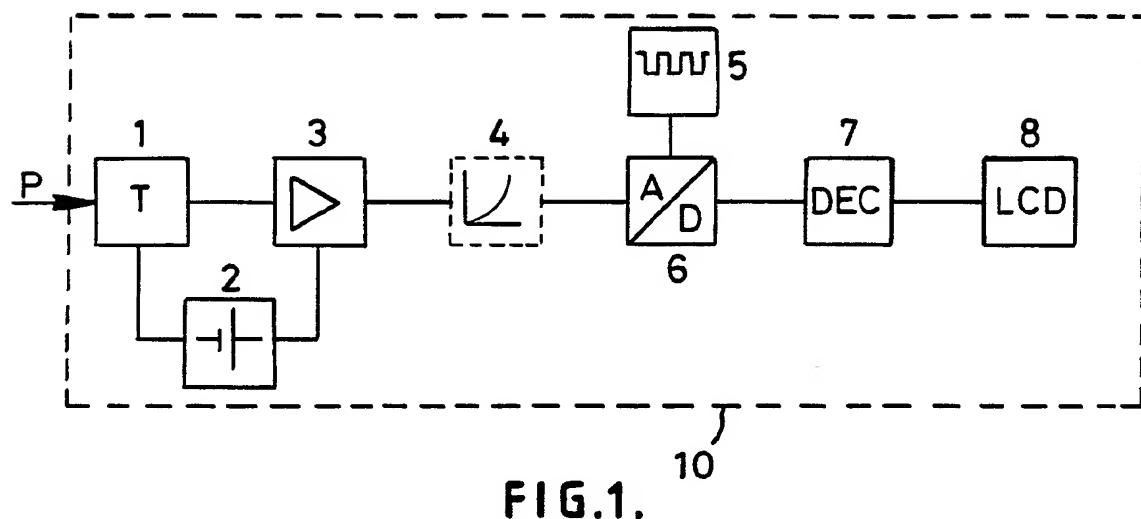


FIG.1.

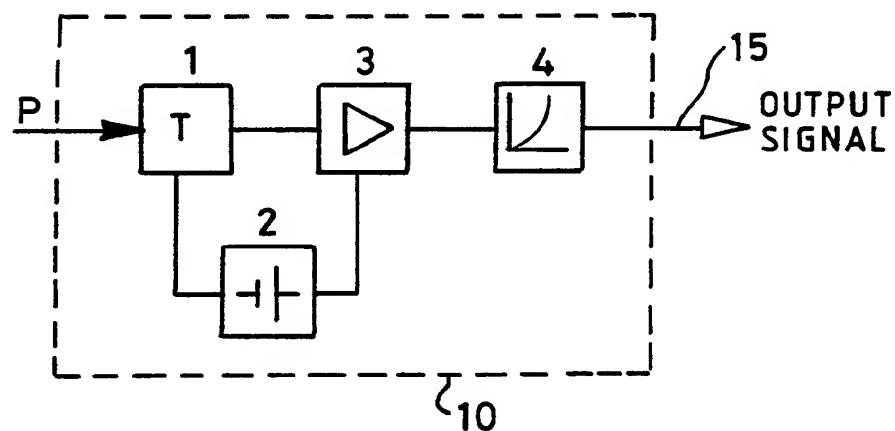
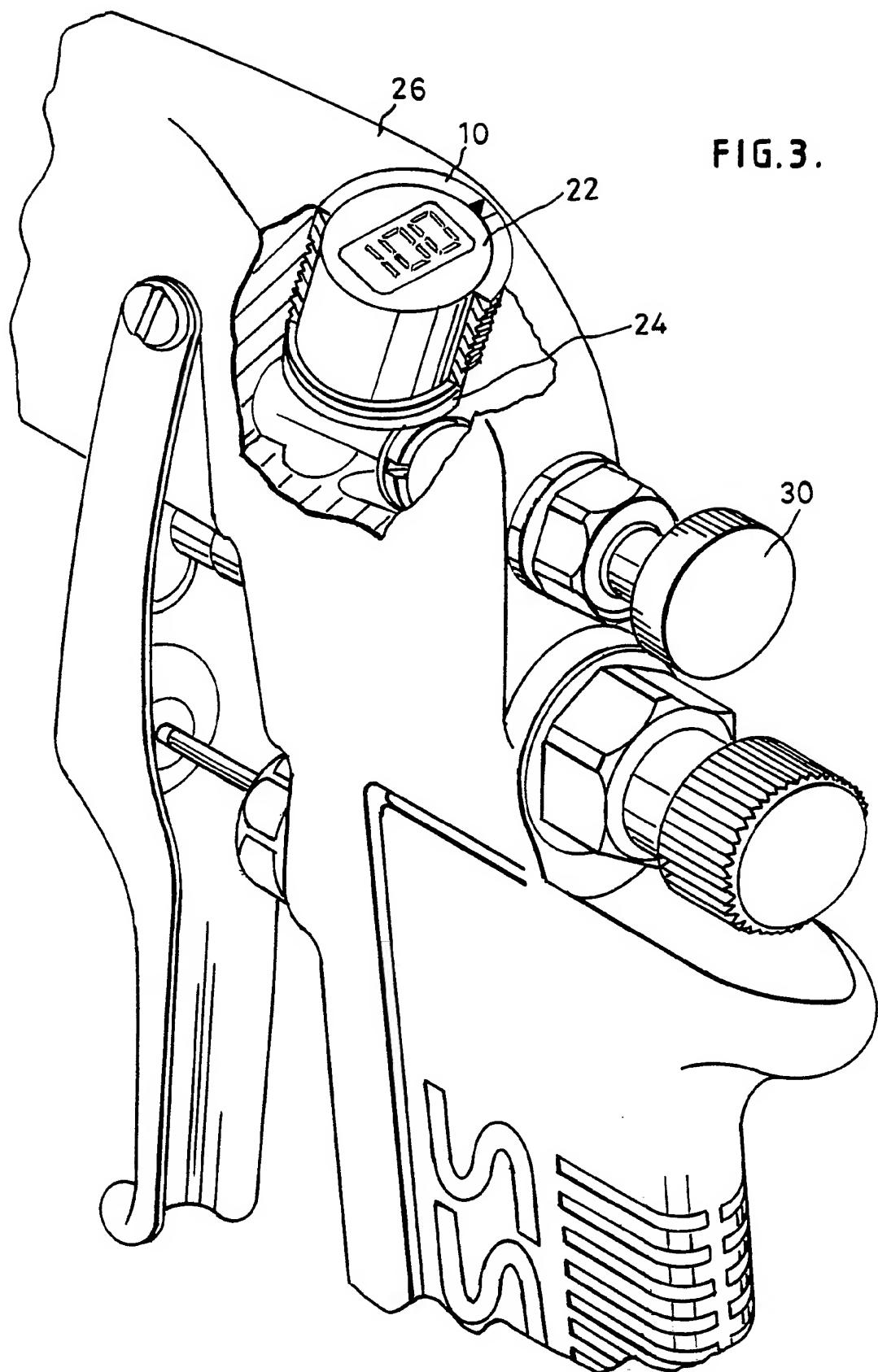


FIG.2.

2-4



3-4

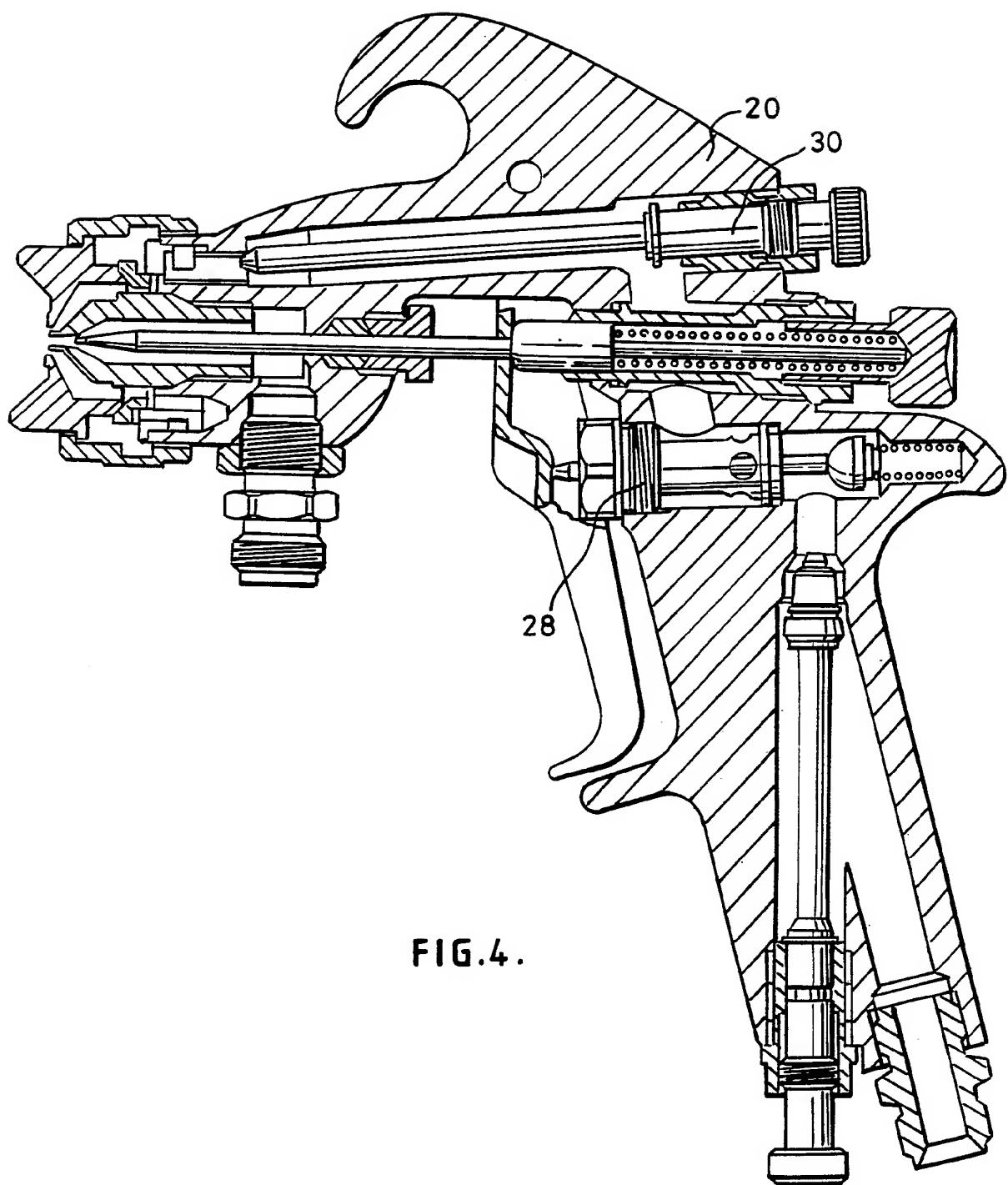
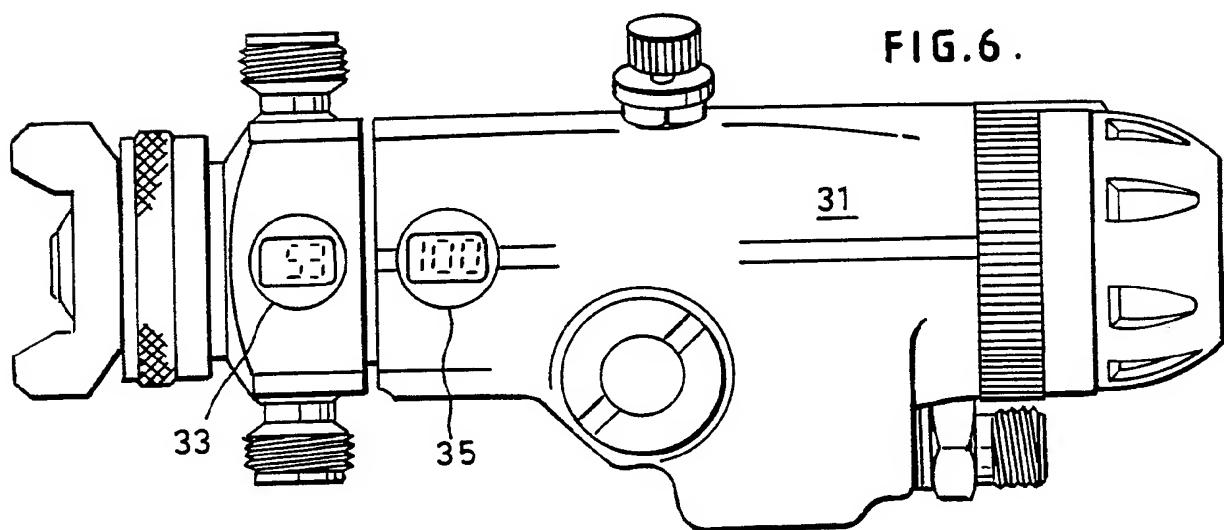
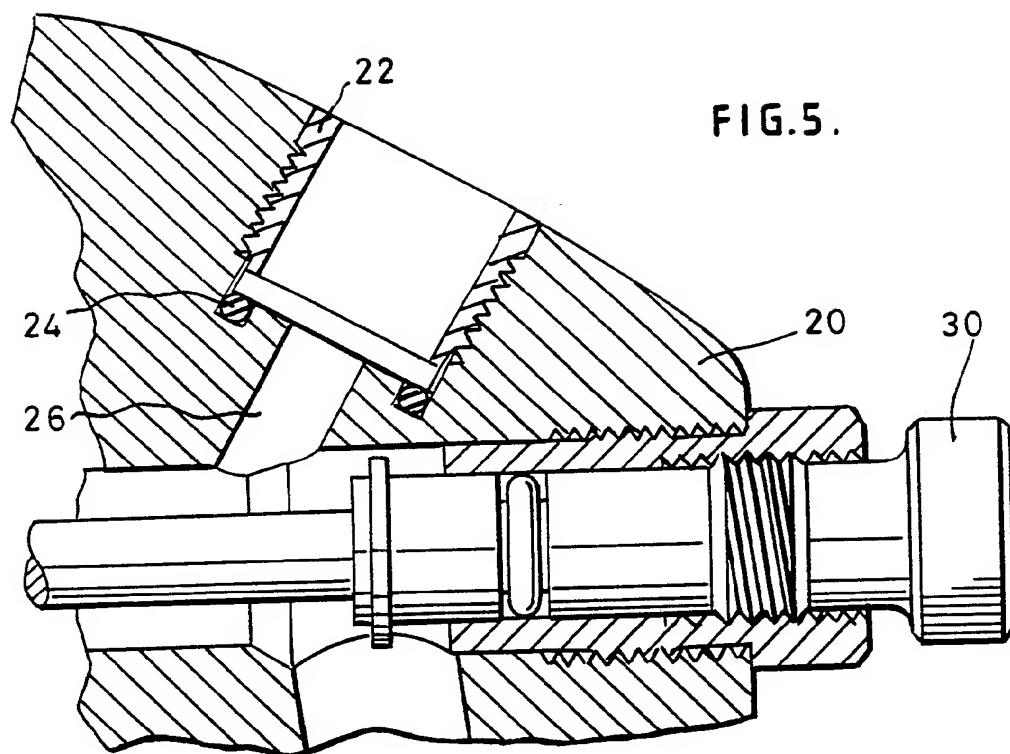


FIG.4.

4-4



INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 9100652

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)⁶

According to International Patent Classification (IPC) or to both National Classification and IPC
 G 01 L 19/00 B 05 B 15/00

II. FIELDS SEARCHED

Minimum Documentation Searched⁷

Classification System	Classification Symbols		
Int.C1.5	G 01 L	B 05 B	B 05 B

Documentation Searched other than Minimum Documentation
 to the Extent that such Documents are Included in the Fields Searched⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	F&M Feinwerktechnik & Messtechnik, vol. 97, no. 12, (München, DE), H.C. Rapp-Hickler et al.: "Feinwerktechnik und Dünnfilmtechnologie im elektronischen Manometer", pages 563-566, see page 564, left-hand column; figures 1-2 ---	1,2
Y	---	4
X	GB-A-2 189 887 (M.S. SLANEY) 4 November 1987, see abstract; figures	1,2
Y	---	4
Y	US-A-4 108 008 (T.W. JOWETT et al.) 22 August 1978, see figure 2 ---	1,2 -/-

* Special categories of cited documents :¹⁰

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

17-07-1991

Date of Mailing of this International Search Report

17.09.91

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

Danielle van der Haas

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	Patent Abstracts of Japan, vol. 10, no. 225 (P-484)[2281], 6 August 1986, & JP-A-61 61 029 (AISIN SEIKI CO. LTD) 28 March 1986, see abstract; figure ---	1
Y	EP-A-0 084 445 (NORDSON CORP.) 27 July 1983, see abstract; page 5, lines 28-33; figures 1,2 ---	4
A	Und-Oder-Nor + Steuerungstechnik, vol. 22, no. 12, December 1989, (Mainz, DE), P. Mihm: "Anpassung neuer piezoresistiver Druckmessumformer an verschiedene Prozeßanschlüsse", page 72, see whole document -----	2,3

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.

GB 9100652
SA 46787

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 06/09/91
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2189887	04-11-87	None	
US-A- 4108008	22-08-78	None	
EP-A- 0084445	27-07-83	US-A- 4430886 14-02-84 AU-B- 560281 02-04-87 AU-A- 1026983 21-07-83 CA-A- 1200299 04-02-86 JP-A- 58146820 01-09-83	